

AUTOSTIL and MAXISTIL

Meeting your needs for pure and ultrapure water with state-of-the-art ion exchange technology; simple and economic demineralised water production

Ion exchange is a process where the ions¹ in solution are exchanged with others by contact with a solid ion exchange material². Normally, spherical ion exchange resins are used, which are packed into a column to build a solid bed. The solution to be treated flows through the resin bed where the ion exchange process takes place.

In the production of pure and ultrapure water, this well proven technique process is among the most commonly applied. All cations are exchanged by means of cation resin with H⁺-ions and all anions by means of anion resin with OH⁻-ions. These two ions combine to H₂O, elementary water molecules, and thus «salt-free» or «fully demineralised» water is produced.

After a certain period the ion exchange resins are exhausted and must be regenerated: The cation exchanger is regenerated with acid (e.g. HCl) and the anion exchanger with a caustic solution (e.g. NaOH).



Conventional resin



Monodisperse resin

¹ cation: positively charged,
anions: negatively charged

² beads, powder, fibres or membranes



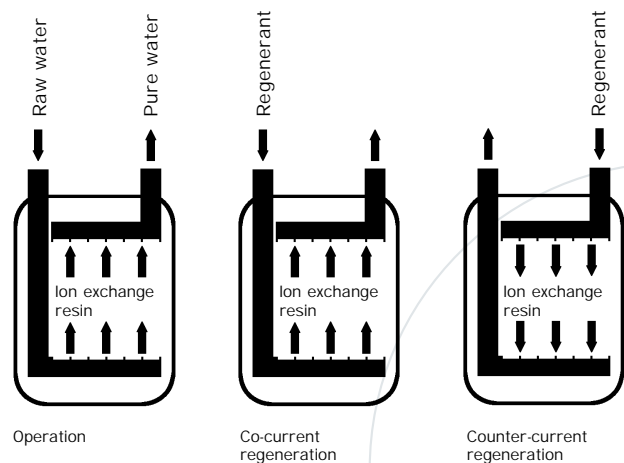
The production of fully demineralised water by means of ion exchange can be effected with two main processes.

Twin Bed Units

In the CHRIST AUTOSTIL-units the raw water is passed through two separate resin columns, firstly through a cation exchange unit and then similarly through an anion bed. This process guarantees pure water qualities of 1 to 10 $\mu\text{S}/\text{cm}$, depending on the regeneration process and raw water quality.

Using the proven co-current technique (AUTOSTIL ZVA), where raw water and regenerants flow in the same direction, a conductivity of 3 to 10 $\mu\text{S}/\text{cm}$ is achieved. The counter-current technique (AUTOSTIL ZGA), where raw water and regenerants flow in opposite directions, provides for a better pure water quality (1 to 2 $\mu\text{S}/\text{cm}$) with less regenerant use and less wastewater from the regeneration process.

The installation of a CO_2 -degasifier between cation and anion columns as well as the application of monodisperse resins - with a regular bead size - are further means by which the consumption of regeneration chemicals and water can be minimised. CHRIST AUTOSTIL-units are built in a series handling flow from 3 to 20 m^3/h and are automatically controlled by PLC and conductivity meters. The regeneration is initiated by the detection of a conductivity increase in the treated water. Customised units are available from the Christ Water Technology Group with higher flow rates for the largest industrial applications.



Mixed-Bed Units

In CHRIST MAXISTIL-units, cation and anion resins are mixed in one vessel, effectively form an infinite chain of cation and anion exchangers. This is advantageous for the equilibrium of the ion exchange process and enables water in the purity of 0.2 to 0.055 $\mu\text{S}/\text{cm}$ to be produced (0.055 $\mu\text{S}/\text{cm}$ is the theoretical conductivity of ultrapure water at 25°C).



The regeneration with acid and caustic is effected in the same column (internal regeneration) or in a separate vessel (external regeneration), after backwashing with water, causing the separation of the cation and anion resins thanks to their differing densities.

After their regeneration both resins are mixed again with air or nitrogen and rinsed with fully demineralised water.

Today's MAXISTIL technology is based on the important pioneering work which Christ performed dating back to 1948, and which has developed based upon the experience of building hundreds of mixed-bed filters since that time, with a continuous product improvement program. Many of these process enhancements have been patented by Christ, such as the separate pure water collecting and chemical distribution systems, and the means of regenerating the resins with raw water, and the development of the external regeneration system known as MOVEX.

These developments ensure

- Consistent pure and ultrapure water qualities
- Low volumes of regenerant wastewater
- Optimised regenerant consumption
- Pre-neutralised wastewater
- No contamination of the ultrapure water by chemicals

CHRIST MAXISTIL-units can be built in various configurations depending on the pure water quality needed and the clients' flow requirements

- Single or duplex plants
- Cross operation (KS-System)
- Parallel operation (MRS-System)
- Merry-go-round (MGR-System)
- Externally regenerated (MGR-MOVEX-System)

In the MGR-MOVEX-System exhausted ion exchange resins are transported into special vessels, where a higher degree of regeneration can be reached and a contamination of the pure water by regenerants is totally avoided. Independently from these various combinations, the MAXISTIL standard series caters for the 3 to 80 m³/h flow range. Customised units are designed for much larger capacities depending on the specific customer needs e.g. up to 1,550 m³/h for condensate polishing in a single vessel.

Using a PLC system a MAXISTIL plant can run fully automatically without supervision. Conductivity increase or, when an on-line analysis device is employed, silica or boron breakthrough actuates the regeneration.



The two CHRIST ion exchange technologies AUTOSTIL and MAXISTIL may be combined to make the pure and ultrapure water production even more economic. Together with membrane processes, ultra-violet treatment and degasification, these units provide critical treatment steps for pure water production in the boiler feed, pharmaceuticals and life sciences arenas, and more specifically for the semiconductor industry.



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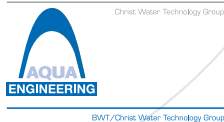
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